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BREEDING SEABIRD POPULATIONS IN GROSWATER BAY, LABRADOR, 1978 AND 2002

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Summary

Populations of breeding seabirds were surveyed in northern Groswater Bay Labrador (54° 19 – 44' N, 57° 6 – 27' W) in 1978 and 2002. Complete ground surveys were conducted of six islands in both years (Bacalhao, East Big, North Green, the Doughboy, Tinker and Puffin Island). The Herring Islands and Quaker Hat were surveyed by ground in 1978, while only boat counts were conducted in 2002. Trends for Atlantic Puffins (*Fratercula arctica*) varied among islands, with two showing declines, three being stable and one showing an increase. In all, 4651 ± 716 (3377 – 6640; 95% CI) puffins bred on these six islands in 1978, while 3468 ± 521 (2165 – 4772) bred in 2002. Razorbill (*Alca torda*) populations increased substantially, from 511 pairs in 1978 to 1645 pairs in 2002 on the six islands. Common Murre (*Uria aalge*) numbers also increased, from 186 pairs breeding on one island (North Green) in 1978, to 744 pairs breeding on three islands (North Green, Puffin and the Doughboy) in 2002. Boat counts indicated that Thick-billed Murre (*U. lomvia*) populations have also increased slightly, with 612 standing adults noted on two islands (Herring-2 and Quaker Hat) in 1978 to 811 standing adults on three islands (Herring-2 and 3, and Quaker Hat) in 2002. Although comparisons are not possible with 1978, a minimum of 227 pairs of Common Eider (*Somateria mollissima*) bred on the six islands in 2002. Great Black-backed Gull (*Larus marinus*) populations have declined from 62-75 pairs in 1978 to 29 pairs in 2002. Northern Fulmars (*Fulmarus glacialis*) were seen on two breeding sites on Herring-3 (Sardine Island) in 2002, and may now breed there. Moulting Harlequin Ducks (*Histrionicus histrionicus*) were seen on Tinker Island (14 males), Puffin Island (4 males) and Herring Islands (9 males) in 2002. Populations of seabirds breeding in northern Groswater Bay appear to be healthy and are showing trends similar to other colonies in Labrador. A reduction in human-induced disturbance from fishery activity in the region is likely to have been beneficial to local seabird populations.

Résumé

En 1978 et en 2002, les populations d'oiseaux de mer nicheurs ont été dénombrées dans la partie nord de la baie Groswater, au Labrador (54° 19–44' nord, 57° 6–27' ouest), au moyen de recensements au sol complets effectués à six endroits (îles Bacalhao, East Big, North Green, Doughboy, Tinker et Puffin). Les îles Herring et Quaker Hat ont fait l'objet d'un dénombrement au sol en 1978, mais uniquement d'un dénombrement par bateau en 2002. Les tendances qui se dessinent chez le macareux moine (*Fratercula arctica*) varient d'une île à l'autre : il y a régression de la population dans deux des îles, stabilité dans trois autres et augmentation dans la dernière. En 1978, 4 651 ± 716 (entre 3 377 et 6 640; IC de 95 %) macareux en tout avaient niché sur les six îles. Pour 2002, ces chiffres avaient baissé à 3 468 ± 521 (entre 2 165 et 4 772). En revanche, les populations de petits pingouins (*Alca torda*) ont connu une forte augmentation; elles sont passées de 511 paires en 1978 à 1 645 paires en 2002 dans les six îles. Les guillemots marmettes (*Uria aalge*) sont également plus nombreux, passant de 186 paires nichant sur une île (île North Green) en 1978 à 744 paires nichant sur trois îles (îles North Green, Puffin et Doughboy) en 2002. Les dénombrements effectués par bateau révèlent que la population de guillemots de Brünnich (*U. lomvia*) a elle aussi connu une légère progression. En 1978, 612 adultes debout avaient été recensés sur deux îles (îles Herring-2 et Quaker Hat), alors que, en 2002, ce chiffre avait augmenté à 811 adultes debout sur trois îles (îles Herring-2, Herring-3 et Quaker Hat). Même s'il n'existe aucune donnée pour 1978, il a été possible

de compter au moins 227 paires d'eiders à duvet (*Somateria mollissima*) qui nichaient sur les six îles en 2002. La population de goélands marins (*Larus marinus*) est passée de 62-75 paires en 1978 à 29 paires en 2002. Le fulmar boréal (*Fulmarus glacialis*) était présent dans deux aires de nidification sur l'île Herring-3 (île Sardine) en 2002, et il se peut qu'il y niche désormais. En 2002, il y avait des arlequins plongeurs (*Histrionicus histrionicus*) en mue sur l'île Tinker (14 mâles), l'île Puffin (4 mâles) et les îles Herring (9 mâles). Les populations d'oiseaux de mer qui nichent dans le secteur nord de la baie Groswater paraissent en santé, et elles suivent les tendances observées dans d'autres colonies du Labrador. La réduction des perturbations provenant de l'activité halieutique dans la région leur a probablement été bénéfique.

1. Introduction

Although the island of Newfoundland supports the largest seabird colonies in Atlantic Canada, Labrador also harbours a number of significant breeding concentrations (Brown et al. 1975, Nettleship and Glenn 1992). For example, the Gannet Islands, in southern Labrador, support the largest Razorbill colony (*Alca torda*) in North America (Chapdelaine et al. 2001, Robertson and Elliot 2002a). Labrador represents the northern edge of the core eastern North American breeding range of Common Murres (*Uria aalge*), Razorbills and Atlantic Puffins (*Fratercula arctica*), and is at the southern edge of the range of Thick-billed Murres (*Uria lomvia*). Large concentrations of breeding Black-legged Kittiwakes (*Rissa tridactyla*) and Northern Fulmars (*Fulmarus glacialis*) are noticeably absent from Labrador. Common Eiders (*Somateria mollissima*), Great Black-backed Gulls (*Larus marinus*) and Black Guillemots (*Cepphus grylle*) are common and widespread nesting species.

Seabird colonies in Labrador face different pressures to those in Newfoundland. Tourism is not yet a major industry in coastal Labrador, yet local people have traditionally used seabird colonies to acquire summer food. As sub-arctic waters surround Labrador colonies, while Newfoundland is in boreal waters, colonies in Labrador are more affected by sea ice, which may surround breeding islands until well into July.

Little information exists on the population size and trends of seabirds breeding in Labrador. To date, the only information on breeding population trends comes from the Gannet Islands south of Groswater Bay (Robertson and Elliot 2002a). This report presents population size estimates for breeding seabirds in six small colonies in northern Groswater Bay based on surveys conducted by GJR and KC from 21 - 27 July 2002, and compares them to estimates from a similar survey conducted by RDE and Remi Odense from 3 - 26 August 1978 (Elliot 1978). 1978 was a particularly late breeding year for all species, with significant amounts of pack ice still present in early July (Birkhead 1993), while 2002 appeared to be an average season in terms of timing. Further, we compare trends in seabird numbers in northern Groswater Bay with those in the Gannet Islands, to assess whether trends in that large colony are representative of seabird breeding populations in Labrador. We also present incidental observations of other bird species, including counts of moulting Harlequin Ducks (*Histrionicus histrionicus*), a federally- and provincially-listed species of special concern.

2. Study site

The study site was centered in northern Groswater Bay (Figure 1), where we surveyed as many colonies as possible that had been surveyed in 1978. A total of six colonies were ground surveyed, with three more islands visited only by boat due to time and sea-state restrictions. A description, based on Elliot (1978) of each island follows:

2.1 East Big Island (54° 27.2'N, 57° 5.7'W)

This was the largest island surveyed, approximately 1 km x 0.6 km in size, and a maximum height of about 70 m. It is relatively steep-sided with crowberry-dominated (*Empetrum* spp.) vegetated slopes on all sides. Small areas of boulder scree are

scattered around the island, and several small cliffs are present. East Big Island was surveyed on 17 August 1978 and 21 July 2002.

2.2 Bacalhao Island (54° 26.7'N, 57° 9.6'W)

Bacalhao is a steep, long and slim basaltic island (600 m x 75 m), running east-west, with cliffs surrounding the island that reach about 40 m in height, with low-lying vegetation present on the ridge and northeast corner. Some grassy areas are present on the southern face. A small, steep-sided islet (50 x 100 m) is present off the west end of the island. Bacalhao Island was surveyed on 17 August 1978 and 21 July 2002, this islet was only visited in 1978.

2.3 Tinker Island (near Indian Harbour, 54° 25.4'N, 57° 16.0'W)

This relatively small granitic island (250 m x 100 m, with a maximum height of 20 m) has a large crevice that largely cuts off the western ¼ of the island, but is passable by scrambling on foot. The north face is quite steep, while the remainder of the periphery contains ample boulder scree and crevices. Vegetation is sparse, with crowberry-type meadows in drier areas, and grass-sedge vegetation in moister areas. There are a few ponds on the east side of the island. Tinker Island was surveyed on 6 August 1978 and 23 July 2002. All results for Tinker Island in this document refer to this island, not the Tinker Island near Holton (see 2.8 below).

2.4 The Doughboy (unidentified island E of East Pompey Island, 54° 26.3'N, 57° 21.0'W)

The smallest island surveyed (100 m in diameter), it is relatively steep, with some small cliffs and ample boulder scree. The top of this basaltic island is vegetated with Sea Lime Grass (*Elymus arenarius*). The Doughboy was surveyed on 3 and 6 August 1978 and 24 and 25 July 2002.

2.5 Puffin Island (actually consists of three islands, 54° 24.6'N, 57° 23.3'W)

The main island is dome-shaped with relatively vegetated slopes (600 m x 400 m, with a maximum height of about 40 m). A rocky/sandy spit runs out to the south of the island to a small raised area. The main island has areas of large rubble and some scree around the island. The western tip has a low-lying area containing *Elymus arenarius*, while the southwestern section contains steep and crumbling cliff.

The two smaller islands (Little South Puffin (54° 24.35'N, 57° 23.15'W) and Little East Puffin (54° 24.4'N, 57° 22.7'W)) are similar in size (150 m in diameter, and less then 10 m high) with areas of scree around each island, and vegetated with mix of *Elymus arenarius* and other plants associated with wetter areas (*Potentilla* spp. and mosses). A cleft containing large slabs of rocks is present on the west side of Little South Puffin. The Puffin Islands were surveyed from 3 to 5 August 1978 and 24 July 2002.

2.6 North Green Island (54° 23.5'N, 57° 19.4'W)

North Green (also called Smokey Island) is a relatively low-lying island (600 m x 400 m, with a maximum height of about 20 m) running north-south along the longest axis. Small cliffs are present on west and east faces, while the rest of the island is surrounded by large expanses of boulder scree and a low sloping bedrock facing the south. In areas of puffin activity, typical plants found were *Senecio* spp., Scotch Lovage (*Ligusticum scoticum*) and *Elymus arenarius*, while crowberry barrens were present in interior of island. North Green Island was surveyed on 6 and 7 August 1978 and 22 and 24 July 2002.

2.7 Herring Islands (54° 19.2' – 20.3'N, 57° 5.4' – 7.2'W)

The Herring Islands are a cluster of three main islands and a number of shoals and breakers. The most northerly island (No. 1 or Red Island) is a lower-lying island (450 x 250 m, with a maximum height of about 30 m) with a few small cliff areas, vegetated with short and tall grasses. A light is maintained by Canadian Coast Guard on this island. The middle island (No. 2 or Kipper Island) is a larger, steep island (800 m x 350 m, with a maximum height of 55 m), surrounded by cliffs or steep slopes. The northern tip provides a small harbour and an low area of rubble and scree. The top of the island is vegetated with crowberry barrens. The southerly island (No. 3 or Sardine) lies low on the north side while sloping upward to cliffs on the southwest side and down to a grassy valley on the southeast (300 m x 250 m, with a maximum height of about 30 m). The Herring Islands were surveyed on the ground in 1978 from 19 to 26 August. In 2002, we conducted boat surveys around the three islands on 26 July.

2.8 Quaker Hat (54° 44.2'N, 57° 20.6'W)

A medium-sized oval granitic island (600 m x 300 m, with a maximum height of almost 40 m), with large slabs of sloping rock to the north and east, and basaltic dykes on the southwest. The middle of this flattish island rises in a steep-sided flat-topped cylindrical section. Canadian Coast Guard maintains a light on the top of the island. Quaker Hat was surveyed 10 to 12 August in 1978 and boat surveyed on 27 July 2002.

3. Methods

3.1 Atlantic Puffins

Atlantic Puffin breeding populations were assessed by combining island-wide hole counts with information on hole occupancy rates based on grubbing (reaching in to a hole by hand) a sample of holes. Holes were defined as any suitable entrance that could lead to a puffin burrow, when assessed by an observer standing up. Holes were counted by 2-4 observers walking in parallel, from 2-10 m apart (depending on the density of holes and steepness of terrain) in all areas of potential puffin habitat. Observers followed a transect and counted all visible holes to one side of them. The observer on the outside of the transect laid out a line of rope or stakes to define the limit of the current transect. On the next transect, that observer counted only to the previously defined line and the observer at the other outer edge laid down a new line of markers. In this way, all holes on the island were counted.

For islands with high puffin burrow densities - North Green Island and Puffin Island in both years, and Quaker Hat and the three Herring Islands in 1978 (see Elliot 1978) - a number of 25 m^2 plots were laid out to assess occupancy rates of holes. The location of each plot was selected in a representative manner, with attempts made to select areas that represented typical breeding conditions and densities on the island. Once the general location was reached, a pole was put in to the ground and a plot was established from this central point. In 2002, circular plots were created by marking with a can of spray paint tied to a cord 2.82 m long. This method drew a circle of 25 m^2 on the ground within which all holes were examined for their contents (i.e. grubbed). In 1978, 5 x 5 m square plots were established. The number of plots grubbed on each island varied, and depended on density of holes and time available to the field crew on the island. An attempt was made to grub a minimum of four plots on each island.

For islands with low density of holes - East Big (in 2002), Bacalhao, Tinker and the Doughboy), establishing plots was not feasible, as only a few holes would have been contained in a plot. Instead, a predetermined number of holes were decided upon, and workers grubbed all the holes they encountered in a random walk through the occupied habitat. A mixed method was used on Puffin Island in 2002, as it was clear that the north side of the island was sparsely used by puffins, while the south side appeared to be an active puffin breeding area. Therefore, hole counts were separated for these two areas, and plots were used on the south side, while 100 holes were grubbed on the north side.

Counts were recorded on standard data sheets. Holes were classified into the following five categories; *unknown* (in which the end of the burrow could not be reached), *entrance* to another burrow, a *short* burrow (< 30 cm) that was not of sufficient length to accommodate a breeding puffin, an *empty* burrow, or an *occupied* burrow. *Occupied* burrows were those that contained an egg, a chick, an adult, an adult with it's chick or egg, or other evidence of occupancy such as nest material, chick faeces or egg shells from the current season. Useable burrows were defined as *occupied* burrows plus *empty* burrows.

The total breeding population was estimated by multiplying the number of holes by the occupancy rate of the holes that were grubbed. Any breeding puffins that were encountered when conducting searches for murre and Razorbill eggs in rocky areas, were added to the final total. Burrow occupancy rates, although not needed in this report to calculate breeding population size, are presented for ease of comparison with other studies.

3.2 Razorbills and Common Murres

Breeding Razorbill and Common Murre numbers were estimated by directly counting eggs and/or chicks. All areas of appropriate habitat were searched, which included small cliffs and rocky or boulder scree for Razorbills, while murres were found on small cliffs and under large rock slabs. For large areas of suitable habitat, observers slowly walked in a line and examined all crevices visually. Observers called out the species of egg or chick (Razorbill, Common Murre or puffin) found to a recorder. This method provides minimum estimates, as some eggs were likely missed. However,, relatively comprehensive searches were possible for the islands examined in this survey, as cliffs were small and boulder scree areas did not contain many large boulders with deep interstitial spaces. For the 2002 July survey only eggs of Razorbills and

Atlantic Puffins were found, while a few Common Murre chicks were seen, more chicks were counted in the 1978 survey since it was conducted later in the season (August).

For the Herring Islands in 2002, we conducted similar boat counts to those conducted in 1978. However, we were not able to obtain a correction factor (ratio of adults to eggs) for 2002, so only adult counts are presented. These should not be taken as estimates of breeding population size, but rather as indices of population size. More detailed survey results collected at the Herring Islands in 1978 are reported elsewhere (Elliot 1978).

3.3 Thick-billed Murres

Since Thick-billed Murres usually breed on cliffs facing the water, it is usually possible to count breeding birds from a boat. Counts were made from the ground in 1978, while the 2002 data was obtained from boat counts. As with adult counts of Razorbills and Common Murres, these counts should be treated as indices of population size.

3.4 Common Eiders and Great Black-backed Gulls

Both species had completed nesting when the surveys were conducted, so only post-hatch nest counts were possible. For the 2002, the hatching period for these species was 1-2 weeks before the survey was conducted, so most successfully hatched nests were quite easy to detect. All islands were searched entirely for the nests of these two species in 2002, unless mentioned below. Because surveys were conducted later in the season in 1978, no counts were made of eider nests, and as more pairs of nesting gulls may have been missed, the 1978 gull population estimates are considered to be conservative.

3.5 Other species

All observations of other bird species, include records of nesting, were noted when detected. A deliberate attempt was made to search all islands for moulting Harlequin Ducks in 2002.

4. Results

4.1 Atlantic Puffins

Changes in numbers of Atlantic Puffins were noticeably variable across the six islands surveyed (Tables 1 and 2). East Big Island and Puffin Island showed signs of substantial declines, with East Big Island declining by 92%, and Puffin Island declining 68% from 1947 ± 270 (95% CI; 1278 – 2615) breeding pairs in 1978 to 619 ± 79 (415 – 820) in 2002. The small populations on Bacalhao Island, Tinker Island and the Doughboy did not change appreciably, while the population on North Green Island increased 18% from 1978 to 2002.

Reduced number of holes and low occupancy rates categorized declines on East Big Island and the north side of Puffin Island. The south side of East Big Island was completely devoid of puffin burrows by 2002 (Figure 2), and the north side of Puffin

Islands was sparsely used (Figure 3). However, the south side of Puffin Island did not show a reduction in occupancy rates, as the colony remains concentrated in this area. Among islands that maintained similar numbers, occupancy rates on Bacalhao increased, but the island had fewer holes available (Table 1). In contrast, the number of holes on the Doughboy almost doubled, but the hole occupancy rate declined (Table 1).

The number of holes present more than doubled on North Green Island, but it had a reduction in the hole occupancy rate. Occupied burrow densities and occupancy rates were very high in 1978, suggesting that this colony had been recently established. Burrow occupancy rates did not decline very much (0.60 to 0.52).

In all, 4651 ± 716 (3377 – 6640; 95% CI) puffins bred on these six islands in 1978, while slightly fewer 3468 ± 521 (2165 – 4772) pairs bred in 2002.

4.2 Razorbills

In contrast to Atlantic Puffins, Razorbill breeding numbers were higher on all islands in 2002 than 1978 (Table 3), with population growth rates ranging from 1.04 to 1.12. Overall, the numbers counted on the six ground-surveyed islands more than tripled, from 511 pairs in 1978 to 1645 pairs in 2002. Tinker Island showed the highest growth rate and Razorbills now nest over the entire island (Figure 4). Based on adult counts from boats, more Razorbills were seen on 2 of the 3 Herring Islands, and the only island that showed a reduced number (Herring-1) was known to have a Polar Bear (*Ursus maritimus*) present on it in 2002.

4.3 Common Murres

Similar to Razorbills, the Common Murre breeding population has increased in northern Groswater Bay. Two islands had new breeding populations of Common Murres in 2002 - the Doughboy (261 pairs; Figure 5) and Little South Puffin Island (38 pairs; Figure 3). Populations on North Green Island more than doubled (186 pairs to 445) in number between 1978 and 2002, and new areas of the island contained breeding populations (Figure 6).

4.4 Thick-billed Murres

Thick-billed Murres continue to breed in the Herring Islands, and have expanded from breeding only on Herring-2 (Kipper Island) in 1978 to also breed on Herring-3 (Sardine Island) in 2002 (Table 4; Figure 7). On Quaker Hat, the number of Thick-billed Murres appears not to have changed much in the last 24 years. However comparisons must be made with caution, as the 1978 numbers result from relatively precise intensive counts from on the island, and 2002 counts were made from a moving boat (Table 4; Figure 8). Overall, the population of Thick-billed Murres breeding in northern Groswater Bay appears to be stable at colonies that existed in 1978, and has slightly increased overall with an additional breeding site on Herring-3 (Sardine Island).

4.5 Great Black-backed Gulls

Great Black-backed Gull breeding populations declined considerably between 1978 and 2002 on all islands (Table 5) from 62-75 pairs in 1978 to 29 pairs in 2002.

Although counts in 1978 and 2002 were conducted well after hatching and should be considered minima. Counts were made earlier in 2002, counts from that year should be higher if any bias exists.

4.6 Common Eider

Significant breeding populations of eiders were found on several islands in 2002 (Table 6), and a total of 227 nests were counted. As these are post-hatch counts, they should be considered minima that underestimate the true breeding numbers. Comparisons with 1978 are not possible, as surveys were conducted too late to count hatched nests. However, it does appear that the number of breeding eiders in northern Groswater Bay has increased.

4.7 Other species

4.7.1 Harlequin Ducks

Moulting Harlequin Ducks were observed on Tinker Island (14 males), Little East Puffin Island (4 males), and Herring-3 (Sardine Island) (9 males) in 2002. No Harlequin Ducks were seen on the other islands, nor around Smokey and Indian Harbour or any of the White Bear Islands. In 1978, there was a single unconfirmed record of 60+ young/eclipse 'probable' Harlequin Ducks (possibly White-winged Scoter *Melanitta fusca*) on Herring-1 (Red Island).

4.7.2 Northern Fulmar

Two Northern Fulmars were sighted in typical breeding areas (in a grassy area above a cliff) on Herring-3 (Sardine Island) during the 2002 boat survey (Figure 7). However, this record cannot be considered a confirmed breeding record, as this species is known to prospect and occupy potential nesting sites for several years without breeding. In 1978, two fulmars on from the water just west of Herring-2 were reluctant to flush, but were not seen on the island.

4.7.3 Black Guillemot

A nest containing one Black Guillemot egg was found on Bacalhao Island in 2002 (Figure 9). In 1978, and a nest was found with two chicks on the islet just west of Bacalhao, and it was concluded that at least 2 pairs nested there that year.

4.7.4 Other species

Other observations of bird species are listed in Appendix 1.

4.8 Observations at other islands

Casual observations were made of additional islands in 2002 when steaming by to look for moulting Harlequin Ducks and signs of breeding seabirds. We noted a small concentration of puffins and Razorbills on the west side of the easternmost North Duck Island (54° 25.0'N, 57° 9.4' W). On the return trip to Makkovik, we noted puffins (about 200) and Razorbills (about 100) apparently attending a small colony at the southeast tip

of an unnamed Island (54° 50' N, 57° 49.5'W), 1 km ENE of False Cape. We also steamed by the south side of Entry Island, through the middle of Five Island, and around the White Bear Islands to look for breeding seabirds and moulting Harlequin Ducks (Fig. 10). We counted a number of Common Eiders, both females and broods and moulting flocks of males (one flock over 250 birds) and we also noted over 300 Black Guillemots in the area (Appendix 1). No Harlequin Ducks were seen at these sites.

5. Discussion

Overall, seabird breeding populations appear to be faring well in northern Groswater Bay. Although we only have data from two seasons separated by 24 years, our results do show that breeding numbers of Razorbills and Common Murres have increased substantially in northern Groswater Bay. Trends for numbers of Atlantic Puffins varied among colonies. We do not know what patterns of change may have occurred in the last 24 years, nor do we know the current population trend of the various seabird species.

The mix of population trends seen among the six Atlantic Puffin colonies surveyed in northern Groswater Bay, with two declining, three remaining stable and one increasing, highlights the importance of monitoring more than one colony of this species. Even within the five main breeding islands in the Gannet Clusters, puffin numbers increased on three islands and declined on two islands between 1978 and 1999 (Robertson and Elliot 2002a). In Newfoundland, puffin populations appear to have increased at the large colonies in Witless Bay (Rodway et al. 1996, Calvert and Robertson 2002), but declined on Small Island, in the Wadham Islands group, between 1984 and 2001 (Robertson and Elliot 2002b). In 1978, 80% of the puffins surveyed in northern Groswater Bay were found in the Herring Islands and Quaker Hat, which were not re-surveyed in 2002, making it difficult to draw definitive conclusions on regional population change from these results.

Puffin populations appear to go through several stages. After a population has recently colonized an island, the first stage is characterized by very high occupancy rates, as unusable burrows have not yet been dug or have collapsed. North Green Island and the Doughboy were in this stage of colony growth in 1978. In time, more holes are dug and hole occupancy rates decline as more holes become unusable, but the population may remain stable or continue to increase (North Green Island and Doughboy in 2002, and Gannet Clusters GC1 and GC3 in 1999; Robertson and Elliot 2002a). As the colony matures, areas of unusable habitat are abandoned and these holes are covered over. In these cases, the hole counts decline, but occupancy rates remain high as the puffins concentrate in areas of good burrowing habitat (Puffin Island in 2002, Gannet Cluster GC2 in 1999, Small Island in 2001). At the final stages of colony decline, both hole counts and occupancy rates become very low (such as East Big Island in 2002).

Whether all colonies go through this progression is not known. Furthermore, a colony may decrease while habitat degrades and subsequently increase once the habitat recovers. In colonies where habitat does not degrade as greatly (such as rocky habitats or possibly areas of Sea Lime Grass), these changes in hole and burrow densities, and occupancy rates may not occur. It is apparent that colonies in Newfoundland and Labrador show different trends, and any one island may not reflect

the general trend of the regional population. Food availability, presence of predators and other factors also affect the dynamics of puffin populations on specific islands, which underscores the need to monitor many puffin colonies to understand regional population trends and to regularly examine suitable islands that may be sites of future colonies.

In contrast to the puffins, Razorbills and Common Murres showed increases in all colonies we surveyed. However, it should be noted that only 24% of the Razorbills and 4% of the Common Murres counted in 1978 surveys of northern Groswater Bay were actually recorded at the colonies re-surveyed in 2002 (Elliot 1978). The remainder nested at the three Herring Islands and Quaker Hat, which were not surveyed for these species in 2002, and conclusions on regional population trends must thus be considered with caution.

Razorbills are currently increasing at every colony examined throughout their Canadian range (Chapdelaine et al. 2001), and Groswater Bay is no exception. The Razorbill population on the Gannet Islands increased from 6497 pairs in 1978 to 9808 pairs in 1999 (Robertson and Elliot 2002a), so trends there are actually a modest representation of the pattern seen in northern Groswater Bay, where we recorded higher growth rates (Table 5).

In the case of Common Murres, the population of North Green increased substantially, and two small colonies were established on the Doughboy and Little South Puffin. The appearance of two new colonies is encouraging, and highlights the importance of protecting not only existing seabird colonies, but also potential sites to allow for population expansion. In contrast, Common Murre populations appear to have declined from 1983 to 1998 on the Gannet Islands, but these results may reflect impacts of Arctic foxes (*Alopex lagopus*), which were present on the Gannet Islands through much of the mid to late 1990s (Birkhead and Nettleship 1995, Robertson and Elliot 2002a). Populations of Common Murres on the Québec North Shore increased up to 1993 (Chapdelaine 1995) and stabilized by 1998-1999 (Rail and Chapdelaine 2002).

Thick-billed Murre populations are stable or increasing throughout their northwest Atlantic range (Gaston 2002). Although the 2002 data for Thick-billed Murres from this study are only one-time counts from boats of birds apparently incubating, not corrected to estimate numbers of breeding pairs, they show that this small population breeding in Labrador is increasing slightly, and expanding to new sites. Similar increases are apparent for the Gannet Islands (Robertson and Elliot 2002a).

The one species that has clearly declined since 1978 is the Great Black-backed Gull. After enjoying increases throughout the 20th century, many large gull populations have been declining, notably Herring Gulls (*Larus argentatus*) (Chapdelaine and Rail 1997, Robertson et al. 2001). Great Black-backed Gull populations appear to be stable in Newfoundland (Robertson et al. 2001), and stable or increasing further south (Mawhinney et al. 1999, Brown et al. 2001), while they have declined on the Gannet Islands (Robertson and Elliot 2002a). The decline in Great Black-backed Gulls in Labrador likely represents a response to a reduction in human activity along the coast, with the closure of numerous fish plants and seasonal fishing communities (i.e. Smokey near the Groswater Bay colonies and Grady Harbour near the Gannet Islands). Unlike Newfoundland and the Maritimes, Herring Gulls do not nest in large numbers on the Labrador coast. Great Black-backed Gulls may replace Herring Gulls as the dominant

species scavenging human-created wastes on the Labrador coast, and consequently suffered the same population declines as Herring Gulls when these human food sources were no longer available. Certainly this decline cannot be explained by a decrease in their natural prey, such as seabirds, although a reduction in capelin (*Mallotus villosus*) abundance since the early 1990s may help to explain their decline (Hipfner et al. 2000).

Over 200 hatched Common Eider nests were counted in 2002, and it is likely that several hundred pairs of eiders nest on the six surveyed islands. There are many other islands in northern Groswater Bay that could also support breeding populations, so this area could be an important breeding area for this species. There is a sizeable concentration of breeding eiders (1000+ nests) north of Smokey and just southeast of Holton Harbour, and this population is increasing (KC, unpublished data) Surveys in 1978 were conducted too late in the season to count nesting eiders.

Except for gulls, all populations of seabirds nesting in northern Groswater Bay appear healthy. Breeding Common Murres and Razorbills have increased appreciably in number. Hunting restrictions on murres were implemented in the early 1990s, and may have helped Common Murre populations to recover (Chardine et al. 1999), as those breeding in Labrador are subjected to intense harvests as they migrate south to Newfoundland. Razorbills are also taken incidentally in the turr hunt (Chapdelaine 1997), so reductions in harvest may have also helped Razorbill populations. The most profound change in recent decades in northern Groswater Bay, was the abandonment of the fish plant at Smokey in 1992. Residents used to hunt for "a bit of fresh" on Saturdays for Sunday dinner (C. Hiscock, pers. comm.), but with the closure of the plant and the abandonment of the community, little to no hunting now occurs in the area. Murres, Razorbills and eiders were probably the preferred species at the time. Additionally, salmon gill nets were set all around Groswater Bay while the fishery was active in the 1970s and 1980s. Gill net mortality, especially in the breeding season, can represent a significant source of mortality (Piatt and Nettleship 1987, Montevecchi 2002).

Puffins do not fit as well into the general patterns, showing a modest decline since 1978, a similar pattern to the Gannet Islands. Other processes, such as shifts in oceanographic patterns influencing prey distribution, may be limiting the number of breeding puffins. However, puffins on the Gannet Islands fed their chicks mainly sandlance (*Ammodytes* spp.) in the late 1990s, but still maintained a reasonable level of reproductive output (Baillie 2001) when compared to the early 1980s when capelin (*Mallotus villosus*) was abundant. On Small Island, Newfoundland, where capelin is presumably still abundant, the puffin population declined appreciably between 1984 and 2001, while Razorbill numbers increased dramatically (Robertson and Elliot 2002b). In general, it appears that different processes regulate Razorbill and puffin populations.

Three sites supported moulting Harlequin Ducks in 2002; Puffin Island, the Herring Islands and Tinker Island where a total of 27 individuals were sighted. The Herring Islands was already a known moulting site, as a male implanted with a satellite radio was detected moulting there (Brodeur et al. 2002). Northern Groswater Bay was suspected to be a moulting area (Gilliland et al. 2002), but had yet to be confirmed.

The Herring Islands, ranked second only to the Gannet Islands as the largest seabird colony in Labrador, appeared to be healthy. From the little data we were able to

collect in 2002, Razorbill and Thick-billed Murre populations have increased and Northern Fulmars may now breed on the Herring Islands, representing another new colony for this species which has been expanding rapidly in the northwest Atlantic (Stenhouse and Montevecchi 1999). The presence of a Polar Bear on Herring-1 (Red Island), with a concurrent reduced number of Razorbills, highlights the important, and likely regular, role that terrestrial predators (specifically foxes and bears) play in Labrador seabird colonies (Birkhead and Nettleship 1995; Robertson and Elliot 2002a).

Northern Groswater Bay supports a healthy and diverse seabird breeding community. Efforts should be made to survey this region at regular intervals to determine current population trends. Although individual islands in this area represent small fractions of regional populations, each island presents a somewhat independent assessment of the trends of each species, an advantage over monitoring a single colony. Additionally, colonization and extinction events are likely to occur at smaller colonies, so they might provide indications of changes that may not be detected at large colonies. Care should be taken to investigate other islands in the area for signs of breeding seabirds (such as east North Duck and the island off False Cape). Finally, these islands are relatively easy to survey, taking one or two days, and this brief survey time helps to reduce investigator disturbance. The large colony at the Herring Islands should be re-surveyed with a comprehensive ground survey as soon as possible, to update breeding numbers for this important colony.

6. Acknowledgments

The Northern Ecosystem Initiative and the Canadian Wildlife Service, Environment Canada provided funding for this project in 2002 and Labrador Inuit Association provided project support. We thank Billy and Randy Edmunds for their excellent work and good company while completing this survey; we also thank Randy Edmunds and his vessel *Jason's Pride*, for safe and enjoyable transportation to Smokey from Makkovik. Tony Lock of the Canadian Wildlife Service directed the 1978 surveys, and he and Tim Birkhead provided useful discussion on surveys techniques used in that year. Remi Odense provided support for all surveys conducted in 1978, maintaining good humour despite periods of heavy ice, intense storms, dangerous seas and long periods of isolation. A. Boyne provided helpful comments on an earlier version of this report.

7. Literature Cited

Baillie, S. M. 2001. Atlantic Puffin response to changes in capelin abundance in Newfoundland and Labrador: an inter-colony and inter-decade comparison. M. Sc. thesis. Memorial Univ. Newfoundland. St. John's, NF.

Birkhead, T. R. 1993. Great Auk Islands. T & AD Poyser, London.

Birkhead, T. R., and D. N. Nettleship. 1995. Arctic fox influence on a seabird community in Labrador: a natural experiment. Wils. Bull. 107: 397-412.

Brodeur, S., J.-P. L. Savard, M. Robert, P. Laporte, P. Lamothe, R. D. Titman, S. Marchand, S. Gilliland and G. Fitzgérald. 2002. Harlequin Duck *Histrionicus histrionicus* population structure in eastern Nearctic. J. Avian Biol. 33: 127-137.

Brown, R. G. B., D. N. Nettleship, P. Germain, C. E. Tull and T. Davis. 1975. Atlas of eastern Canadian seabirds. Can. Wild. Serv., Ottawa, ON.

Brown, K. M., J. L. Tims, R. M. Erwin and M. E. Richmond. 2001. Changes in the nesting populations of colonial waterbirds in Jamaica Bay Wildlife Refuge, New York, 1974-1998. Northeastern Naturalist 8: 275-292.

Calvert, A. M., and G. J. Robertson. 2002. Using multiple abundance estimators to infer population trends in Atlantic puffins. Can. J. Zool. 80: 1014-1021.

Chapdelaine, G. 1995. Fourteenth census of seabird populations in the sanctuaries of the north shore of the Gulf of St. Lawrence, 1993. Can. Field-Nat. 109: 220-226.

Chapdelaine, G. 1997. Pattern of recoveries of banded Razorbills (*Alca torda*) in the western Atlantic and survival rates of adults and immatures. Colon. Waterbirds 20: 47-54.

Chapdelaine, G., and J.-F. Rail. 1997. Relationship between cod fishery activity and the population of herring gulls on the North Shore of the Gulf of St. Lawrence, Québec, Canada. ICES J. Mar. Sci. 54: 708-713.

Chapdelaine, G., A. W. Diamond. R. D. Elliot and G. J. Robertson. 2001. Status and population trends of the Razorbill in eastern North America. Can. Wildl. Serv. Occ. Pap. No. 105. Ottawa, ON.

Chardine, J. W., B. T. Collins, R. D. Elliot, H. Lévesque, and P. C. Ryan. 1999. Trends in the annual harvest of murres in Newfoundland and Labrador. Bird Trends 7:11-14.

Elliot, R. D. 1978. Seabird colony surveys in the Groswater Bay Area, Labrador – July to August 1978. Unpublished report, Can. Wild. Serv., Atlantic Region. Dartmouth, NS.

Gaston, A. J. 2002. Studies of high-latitude seabirds. 5. Monitoring Thick-billed Murres in the eastern Canadian Arctic, 1976-2000. Can. Wildl. Serv. Occ. Pap. No. 106. Ottawa, ON.

Gilliland, S. G., G. J. Robertson, M. Robert, D. Amirault, J.-P. L. Savard, P. Laporte and P. Lamothe. 2002. Abundance and distribution of Harlequin Ducks molting in eastern Canada. Waterbirds 25: 333-339.

Hipfner, J. M., P. A. Adams and R. Bryant. 2000. Breeding success of Black-legged Kittiwakes, *Rissa tridactyla*, at a colony in Labrador during a period of low capelin, *Mallotus villosus*, availability. Can. Field-Nat. 114: 413-416.

Mawhinney, K., A. W. Diamond, P. Kehoe and N. Benjamin. 1999. Status and productivity of Common Eiders in relation to Great Black-backed Gulls and Herring Gulls in the southern Bay of Fundy and northern Gulf of Maine. Waterbirds 22: 253-262.

Montevecchi, W. A. 2002. Interactions between fisheries and seabirds. Pages 527-557 *in* E.A. Schreiber and J. Burger (eds.), Biology of Marine Birds. CRC Press, Boca Raton, FL.

Nettleship, D. N., and G. N. Glenn. 1992. Seabird colonies in Labrador. Unpublished report, Can. Wild. Serv., Atlantic Region. Dartmouth, NS.

Piatt, J. F., and D. N. Nettleship. 1987. Incidental catch of marine birds and mammals in fishing nets off Newfoundland, Canada. Mar. Poll. Bull. 18: 344-349.

Robertson, G. J., D. Fifield, M. Massaro and J.W. Chardine. 2001. Changes in nesting-habitat use of large gulls breeding in Witless Bay, Newfoundland. Can. J. Zool. 79: 2159-2167.

Robertson, G. J., and R. D. Elliot. 2002a. Population size and trends of seabirds breeding in the Gannet Islands, Labrador. Can. Wildl. Serv. Tech. Rep. Ser. No. 393. Atlantic Region. Mount Pearl, NF.

Robertson, G. J., and R. D. Elliot. 2002b. Changes in seabird populations breeding on Small Island, Wadham Islands, Newfoundland Can. Wildl. Serv. Tech. Rep. Ser. No. 381. Atlantic Region. Mount Pearl, NF.

Rodway, M. S., H. R. Regehr, and J. W. Chardine. 1996. Population census of breeding Atlantic Puffins at Great Island, Newfoundland in 1993-1994. Can. Wildl. Serv. Tech. Rep. Ser. No. 263, Atlantic Region. Sackville, NB.

Stenhouse, I. J, and W. A. Montevecchi. 1999. Increasing and expanding populations of breeding Northern Fulmars in Atlantic Canada. Waterbirds 22: 382-391.

Table 1. Occupancy rates and population sizes (± 1 SE with 95% CI in parentheses) of Atlantic Puffins breeding on East Big, Bacalhao, Tinker and Doughboy Islands, Groswater Bay, Labrador in 1978 and 2002.

	East Big		Bacalhao		Tinker		Doughboy	
	1978	2002	1978	2002	1978	2002	1978	2002
Total holes assessed	46	54	38	20	15	21	45	44
Occupied hole rate	0.370 ± 0.071 (0.226 ± 0.513)	0.056 ± 0.031 (0 – 0.118)	0.289 ± 0.074 (0.141 – 0.438)	0.500 ± 0.112 (0.267 – 0.733)	0.200 ± 0.103 (0 – 0.420)	0.190 ± 0.086 (0.012 – 0.369)	0.600 ± 0.073 (0.453 – 0.747)	0.341 ± 0.071 (0.197 – 0.485)
Occupied burrow rate	0.415 ± 0.073 (0.268 – 0.561)	0.115 ± 0.043 (0.026 – 0.205)	0.440 ± 0.081 (0.274 – 0.606)	0.769 ± 0.094 (0.566 – 0.973)	0.200 ± 0.103 (0 – 0.420)	0.364 ± 0.105 (0.133 – 0.595)	0.628 ± 0.072 (0.483 – 0.773)	0.469 ± 0.075 (0.316 – 0.622)
Hole count	735	357	177	86	43	41	258	506
Population size in holes	272 ± 52 (166 – 173)	20 ± 11 (0 – 42)	51 ± 13 (25 - 78)	43 ± 10 (23 – 63)	9 ± 4 (0 – 18)	8 ± 4 (1 – 15)	155 ± 19 (117-193)	173 ± 36 (100 – 245)
Directly counted in crevices	0	2	5	2	22	21	7	1
Total population size (pairs)	272 ± 52 (166 – 173)	22 ± 11 (2 – 44)	56 ± 18 (30 – 83)	45 ± 12 (25 – 65)	31 ± 4 (22 – 40)	29 ± 4 (22 – 36)	162 ± 19 (124 - 200)	174 ± 36 (101- 246)

Table 2. Occupancy rates and population sizes (± 1 SE with 95% CI in parentheses) of Atlantic Puffins breeding on North Green and Puffin Island, Groswater Bay, Labrador in 1978 and 2002. Occupancy rates from the main the Puffin Island was used to calculate population sizes on Little East and Little South Puffin Island.

	North Green		Puffin	Puffin (south)	Puffin (north)	Little South Puffin		Little East Puffin	
	1978	2002	1978	2002	2002	1978	2002	1978	2002
Number of plots	4	6	7	4	1[a]	-	-	-	-
Occupied hole rate	0.496 ± 0.082 (0.234 – 0.758)	0.286 ± 0.043 (0.176 – 0.396)	0.316 ± 0.044 (0.207 – 0.425)	0.246 ± 0.020 (0.182 – 0.309)	0.078 ± 0.026 (0.025 – 0.130)	-	-	-	-
Occupied burrow rate	0.602 ± 0.083 (0.337 – 0.867)	0.516 ± 0.061 (0.359 – 0.673)	0.390 ± 0.052 (0.262 – 0.518)	0.398 ± 0.015 (0.349 – 0.447)	0.157 ± 0.036 (0.085 – 0.229)	-	-	-	-
Burrow density (m^2)	1.163 ± 0.183 (0.581 – 1.744)	0.646 ± 0.088 (0.419 – 0.873)	0.955 ± 0.138 (0.618 – 1.292)	0.754 ± 0.097 (0.445 – 1.064)	-	-	-	-	-
Occupied burrow density (m^2)	0.741 ± 0.179 (0.171 – 1.311)	0.350 ± 0.069 (0.172 – 0.528)	0.404 ± 0.096 (0.169 – 0.640)	0.299 ± 0.036 (0.185 – 0.414)	-	-	-	-	-
Hole count	4360	8905	5863	1881	1491	165	45	107	36
Population size in holes	2163 ± 358 (1020 – 3305)	2547 ± 383 (1567 – 3526)	1853 ± 258 (1214 – 2492)	463 ± 38 (342 – 581)	116 ± 39 (38 – 194)	52 ± 7 (34 – 70)	11 ± 1 (8 – 14)	34 ± 5 (22 – 45)	9 ± 1 (7 – 11)
Directly counted in crevices	21	34	5	8	5	0	6	3	1
Total population size (pairs)	2184 ± 358 (1041 – 3326)	2581 ± 383 (1601 – 3560)	1858 ± 258 (1219 – 2497)	471 ± 38 (350 – 589)	121 ± 39 (43 – 199)	52 ± 7 (34 – 70)	17 ± 1 (14 – 20)	37 ± 5 (25 – 48)	10 ± 1 (8 – 12)

[a] based on first 108 holes encountered, 51 of which were burrows, 8 were occupied and 5 were unknown

Table 3. Breeding population size estimates (pairs) or indices (Herring Islands) of Razorbills breeding in northern Groswater Bay, Labrador in 1978 and 2002.

Island	1978	2002	λ[a]
East Big	1-5	13	-
Bacalhao	1-3	1-3	-
Tinker	11	164	1.119
Doughboy	47	146	1.048
Puffin Island	32	119	1.056
Little South Puffin	16	92	1.076
Little East Puffin	22	120	1.073
North Green	378	988	1.041
Herring Island (1- Red)	165[b]	129[bc]	0.990
Herring Island (2 - Kipper)	545[b]	1129[b]	1.031
Herring Island (3 - Sardine)	209[b]	446[b]	1.032

[a] population growth rate
[b] boat based counts of adults standing in breeding areas
[c] polar bear (*Ursus maritimus*) present on island

Table 4. Breeding population size estimates of murres breeding in northern Groswater Bay, Labrador in 1978 and 2002. Common Murre counts are based on egg counts, while Thick-billed Murre counts are of adults on cliffs, and represent indices to breeding population size.

Island	1978	2002	λ[a]
Common Murres			
Doughboy	0	261	-
Little South Puffin	0	38	-
North Green	186	445	1.037
Herring Island (1- Red)	587	n.c.[b]	
Herring Island (2 - Kipper)	2027	n.c.	
Herring Island (3 - Sardine)	1519	n.c.	
Quaker Hat	648	n.c.	
Thick-billed Murres			
Herring Island (1 - Red)	0	0	
Herring Island (2 - Kipper)	433	505	1.006
Herring Island (3 - Sardine)	0	150	-
Quaker Hat	179	156	0.994

[a] population growth rate
[b] no count

Table 5. Breeding population size estimates of Great Black-backed Gulls breeding in northern Groswater Bay, Labrador in 1978 and 2002.

Island	1978	2002
East Big	5-10	1
Bacalhao	1-2	1
Tinker	12-15	11
Doughboy	5	1
Puffin Island	4-5	6
Little South Puffin	5-6	0
Little East Puffin	10-12	1
North Green	20	8
Total	62-75	29

Table 6. Breeding population size estimates of Common Eiders breeding in northern Groswater Bay, Labrador in 1978 and 2002. Most nests had hatched by the time of the count, so these estimates should be considered minima. For 1978, only information if eider nests were noted as present (+) was available (an absence does not necessarily mean they were not there).

Island	1978	2002
East Big	-	-
Bacalhao	-	-
Tinker	+	72
Doughboy	-	20
Puffin Island	+	2
Little South Puffin	+	2
Little East Puffin	+	40
North Green	-	91

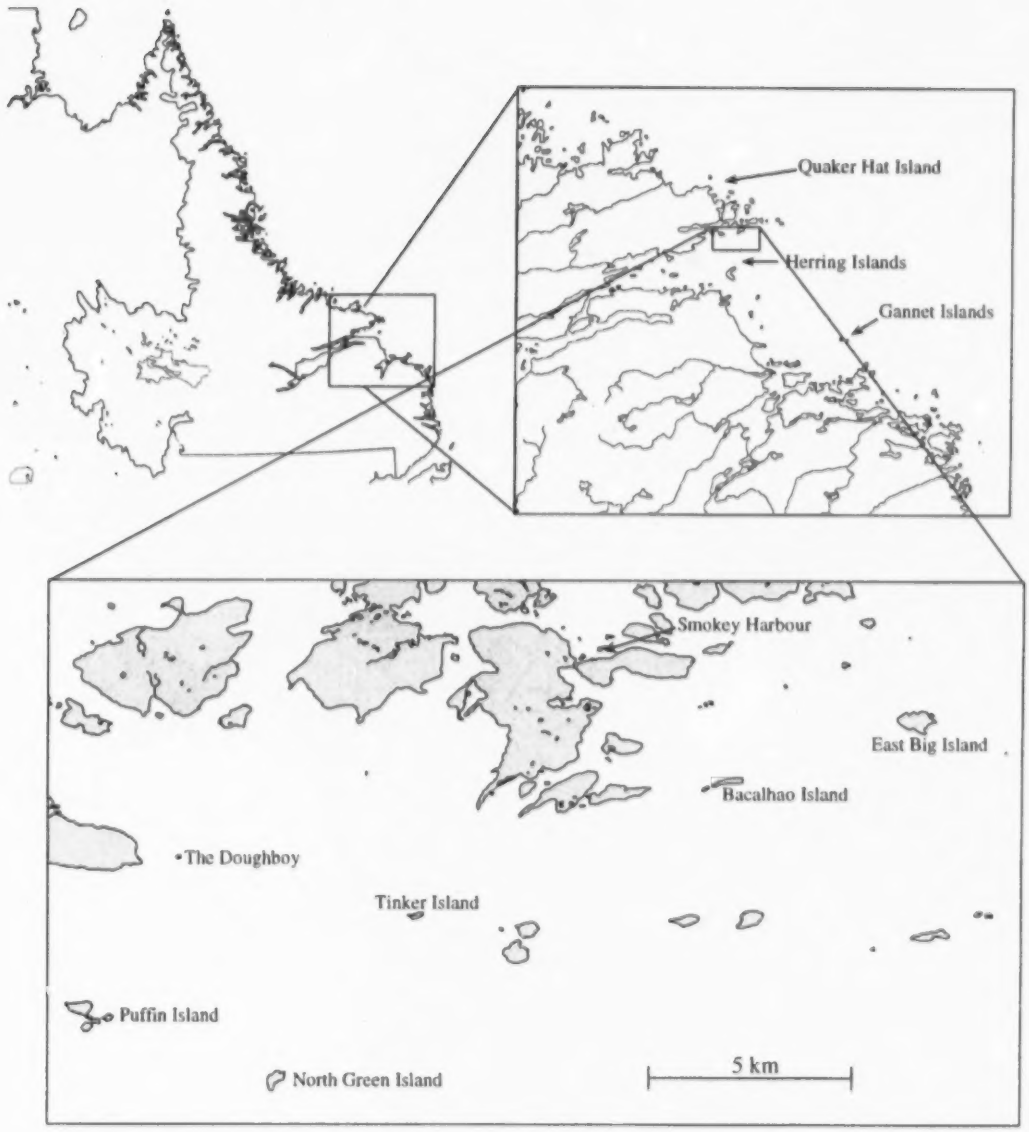

Figure 1. Location of main colonies surveyed in 2002, northern Groswater Bay, Labrador, and the Gannet Islands for reference.

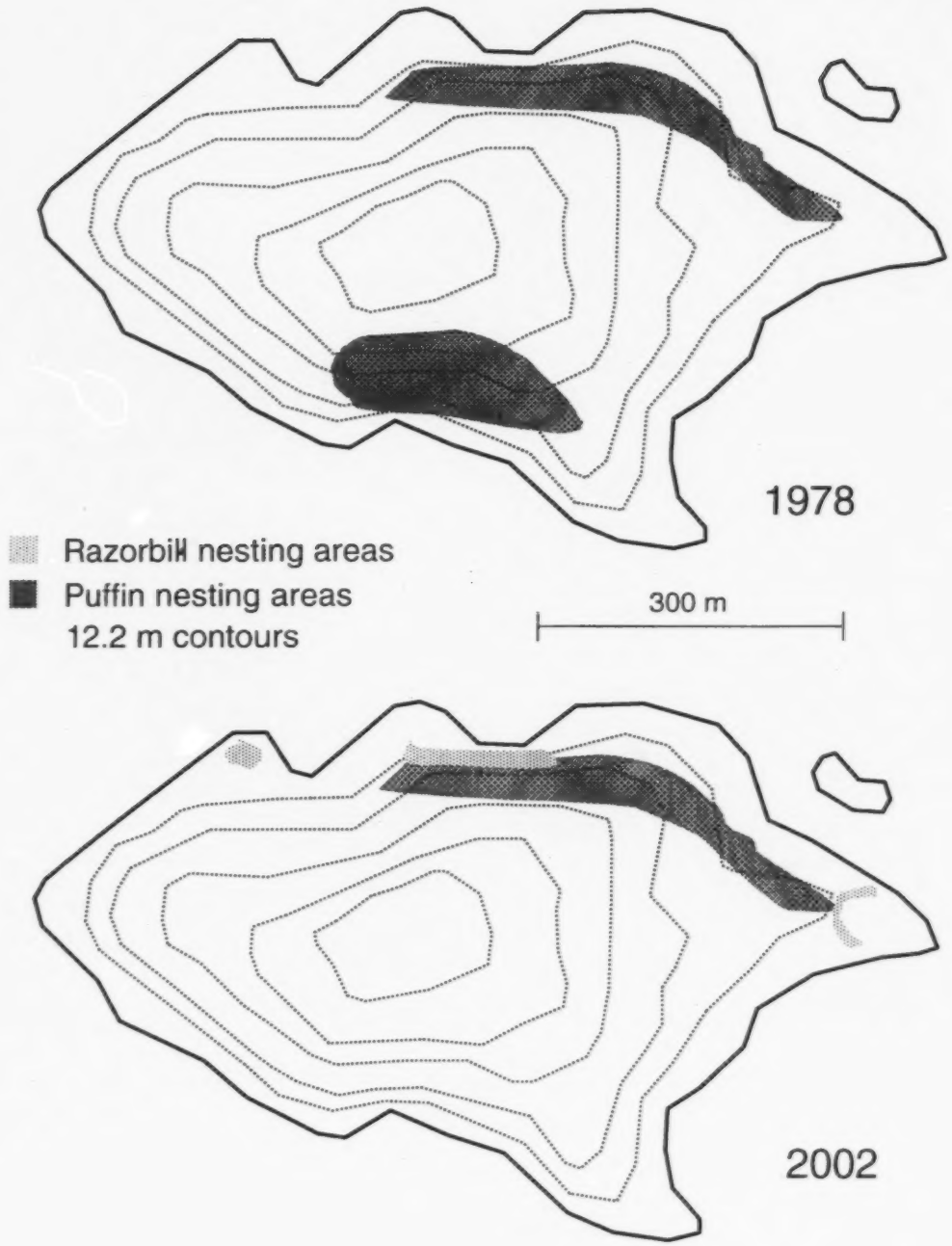

Figure 2. Distribution of breeding seabirds on East Big Island, northern Groswater Bay, Labrador, in 1978 and 2002.

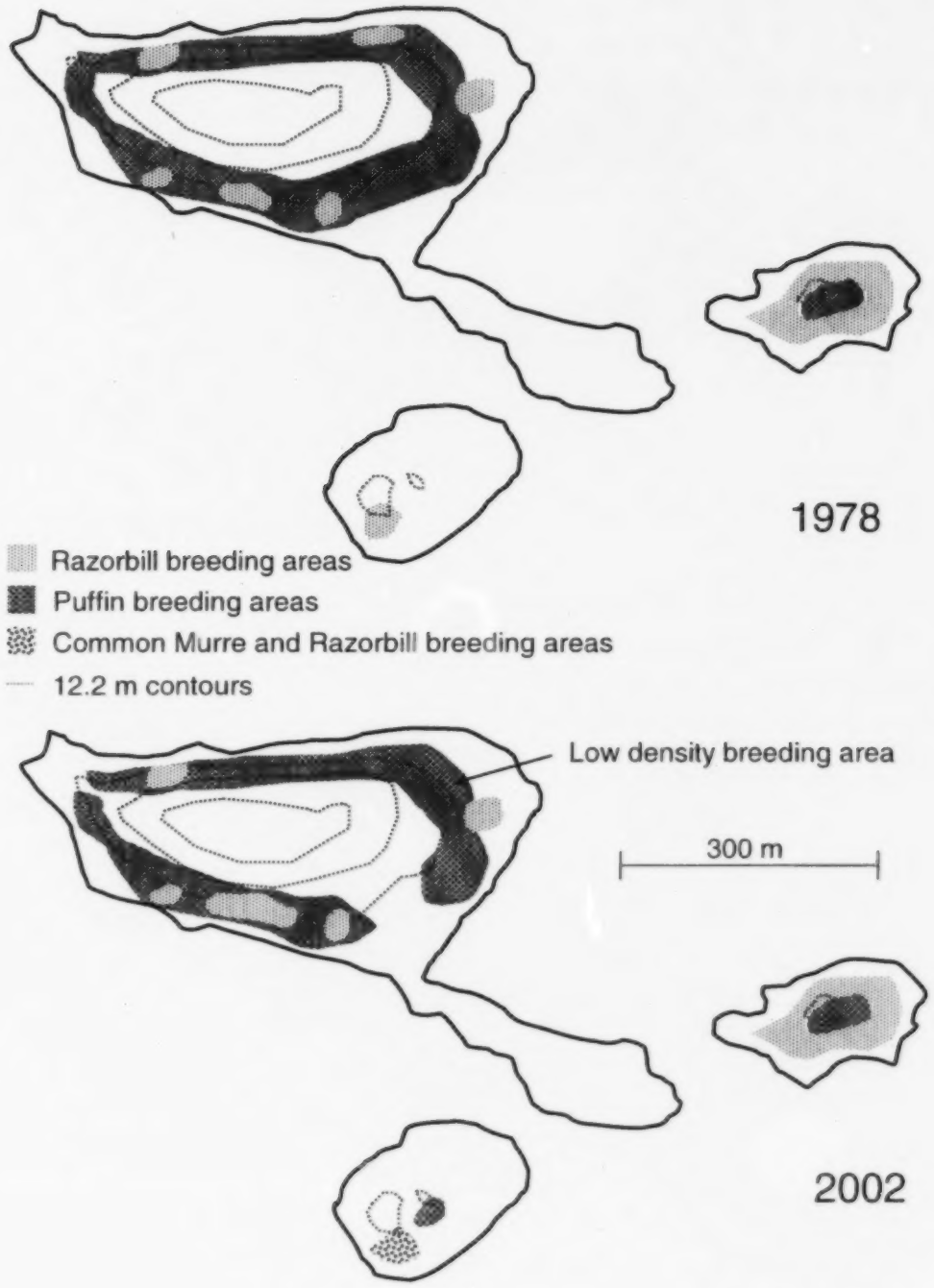

Figure 3. Distribution of breeding seabirds on Puffin Island, northern Groswater Bay, Labrador, in 1978 and 2002.

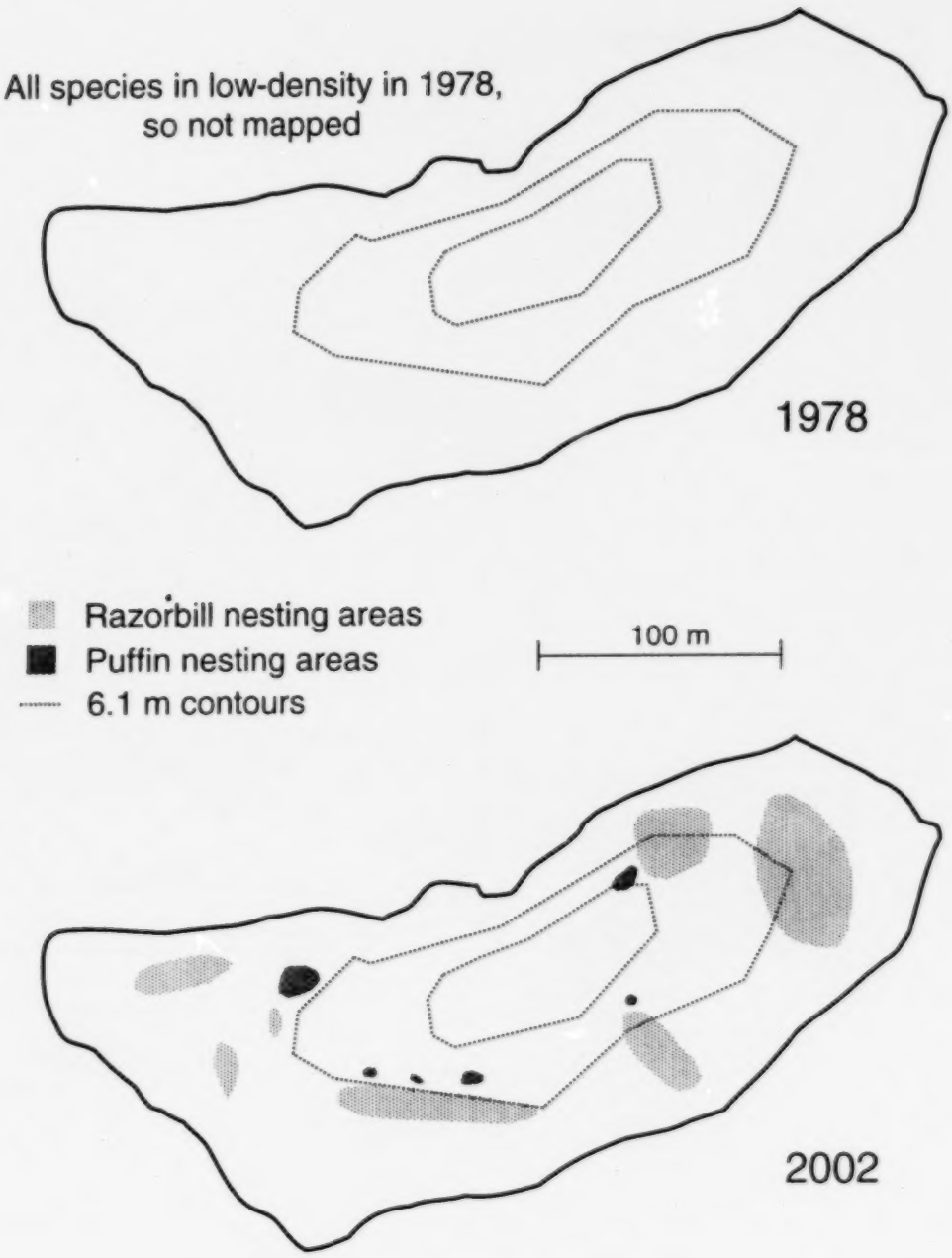

Figure 4. Distribution of breeding seabirds on Tinker Island, northern Groswater Bay, Labrador, in 1978 and 2002.

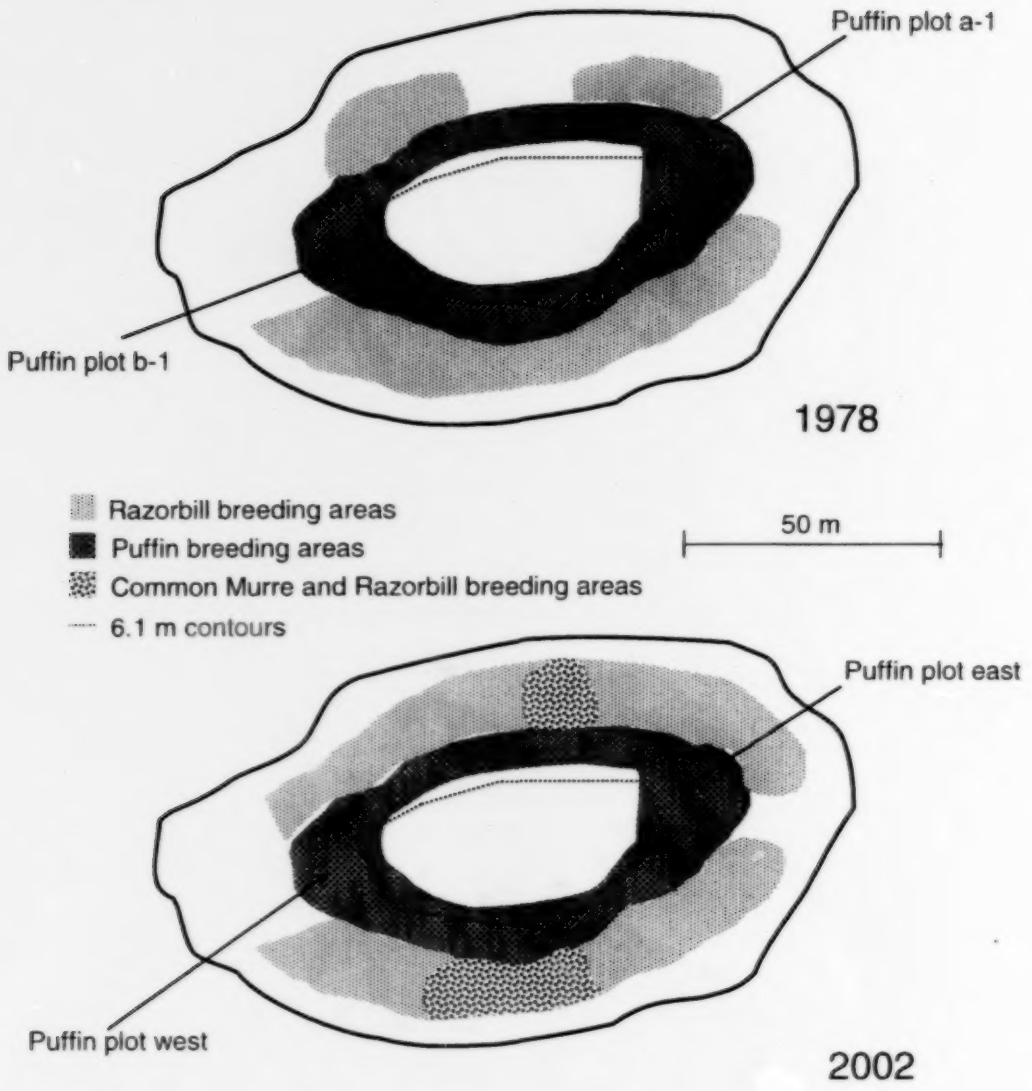

Figure 5. Distribution of breeding seabirds on the Doughboy, northern Groswater Bay, Labrador, in 1978 and 2002.

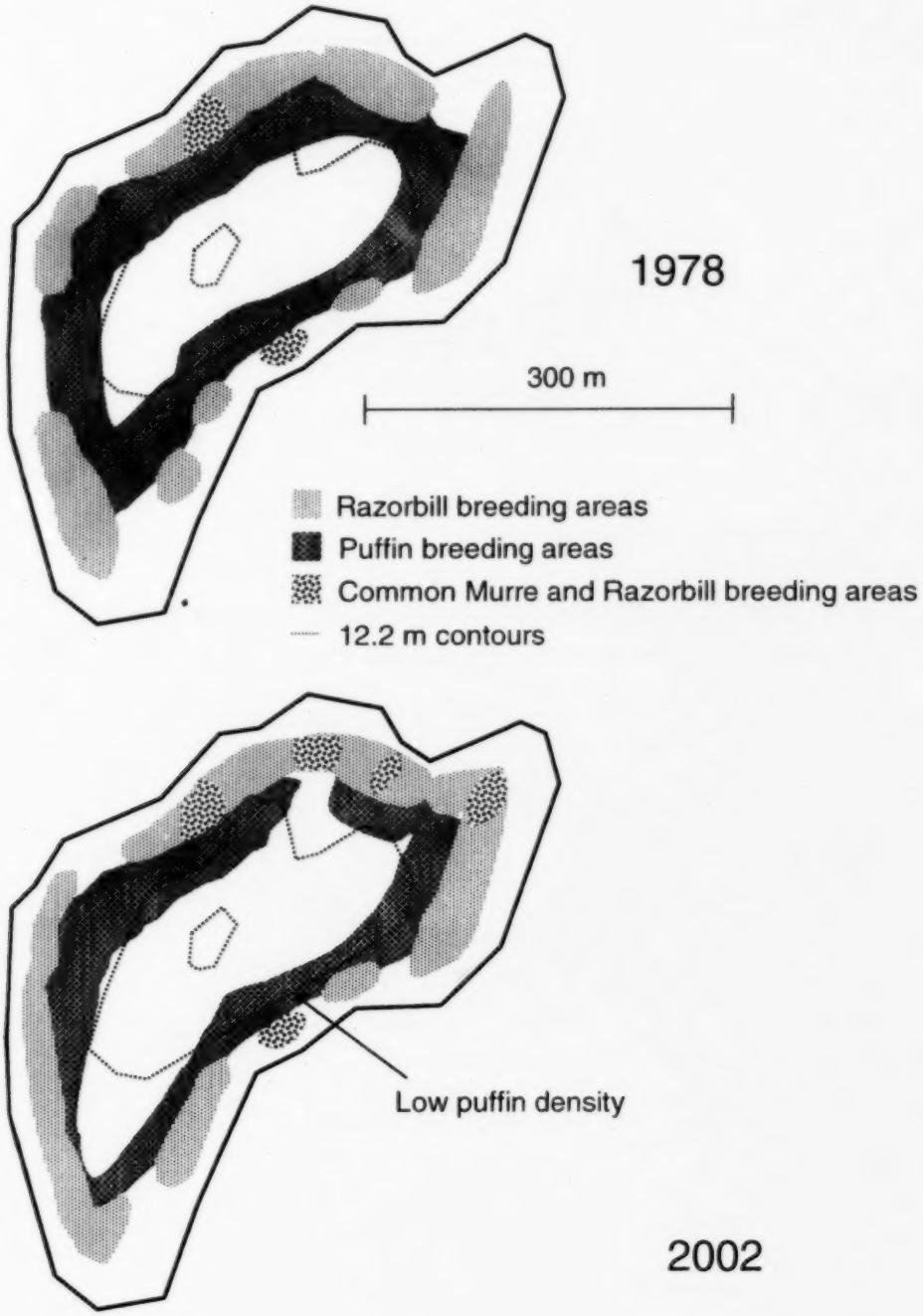

Figure 6. Distribution of breeding seabirds on North Green Island, northern Groswater Bay, Labrador, in 1978 and 2002.

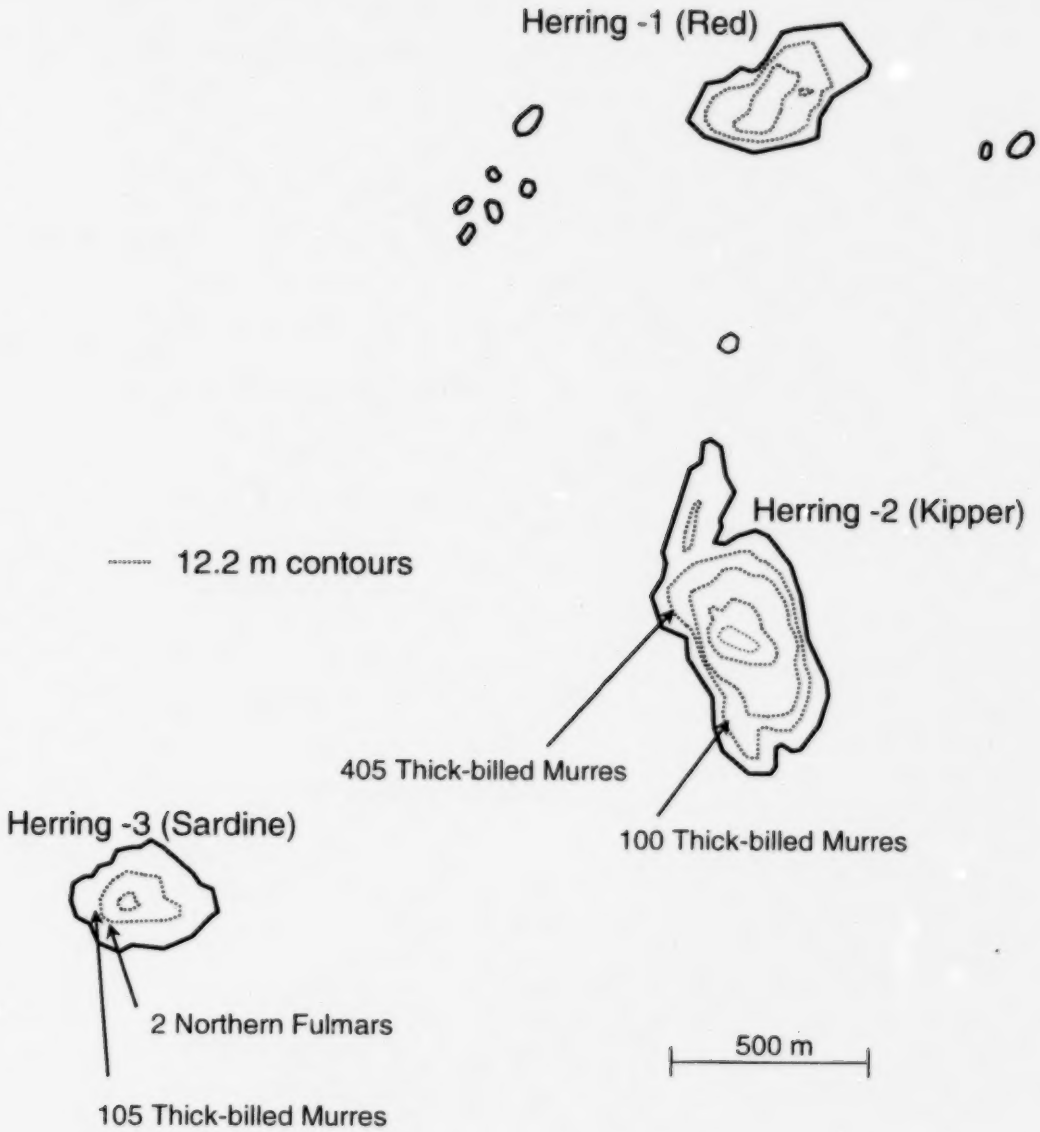

Figure 7. Distribution of cliff nesting seabirds in the Herring Islands, Groswater Bay, Labrador, in 2002. Boat counts of other species are presented in Appendix 1.

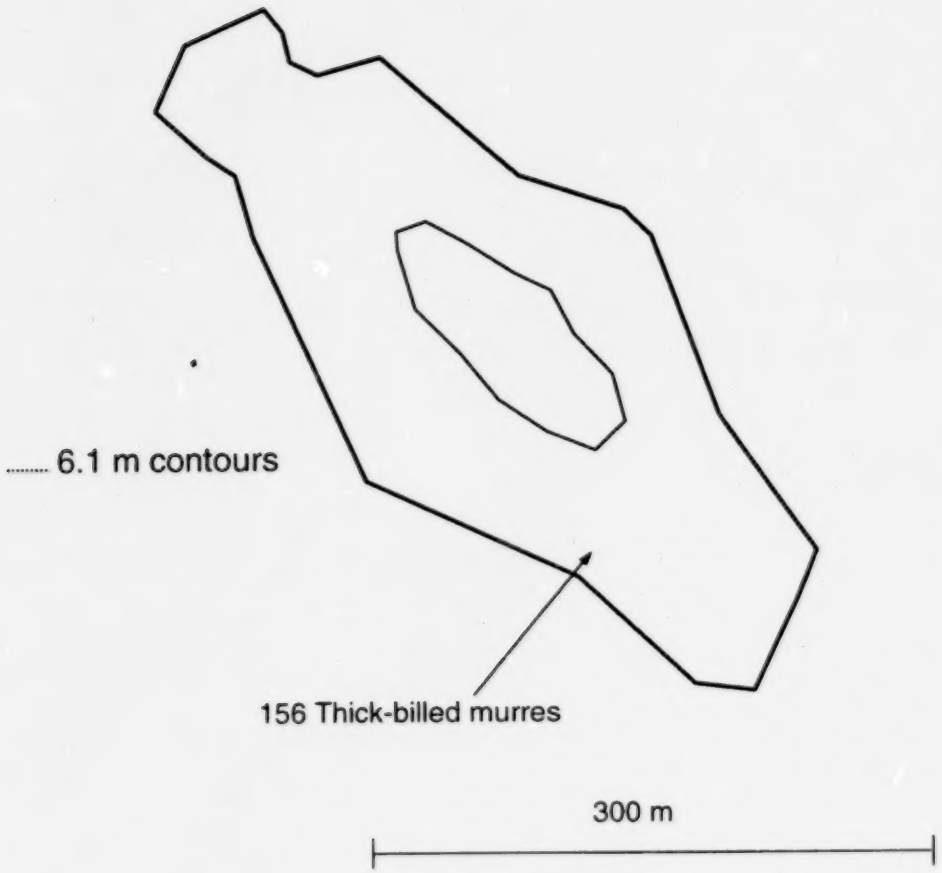

Figure 8. Distribution of cliff nesting Thick-billed Murres on Quaker Hat Island, in 2002. Boat counts of other species are presented in Appendix 1.

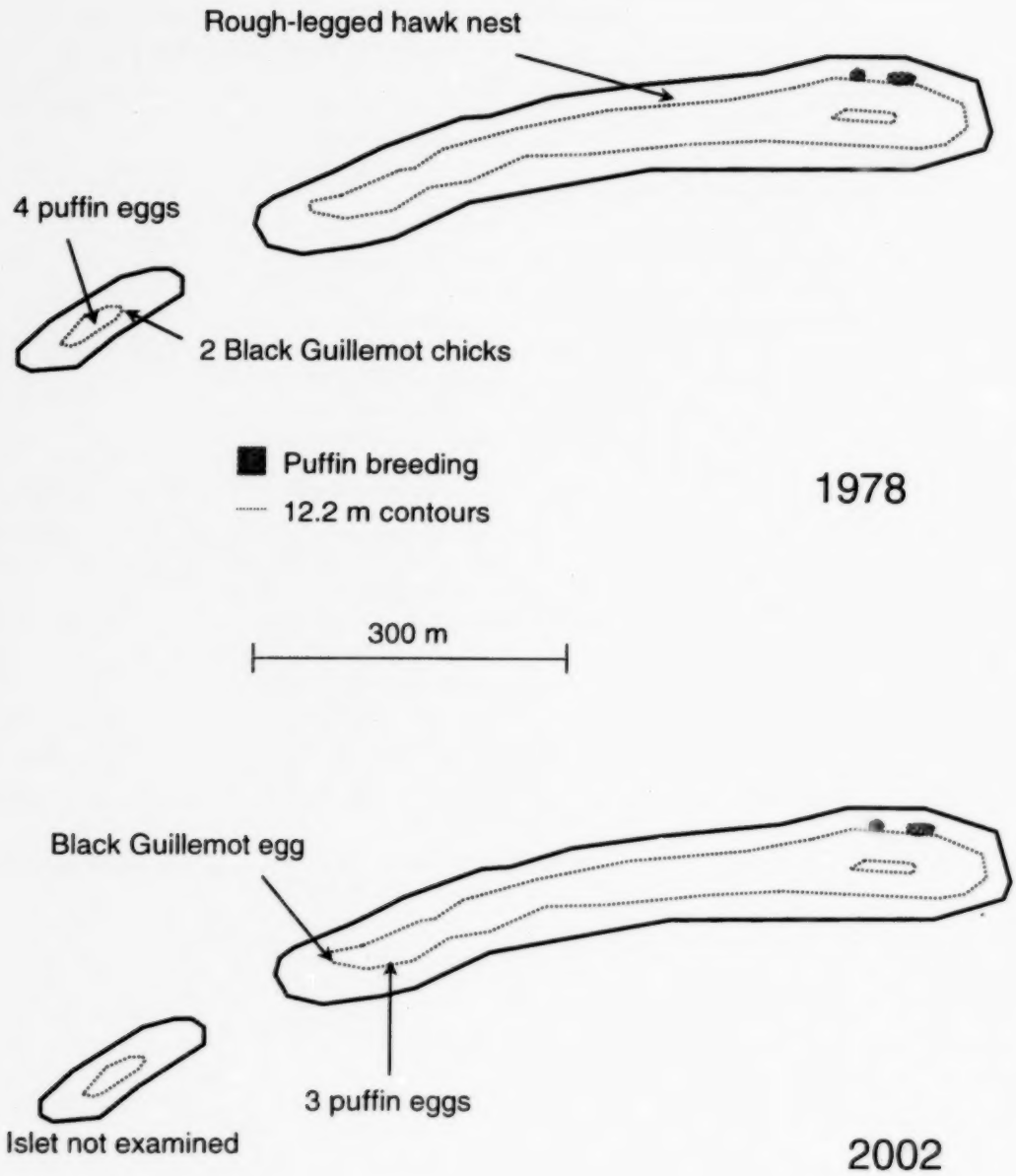

Figure 9. Distribution of breeding seabirds on Eacalhac Island, northern Groswater Bay, Labrador, in 1978 and 2002.

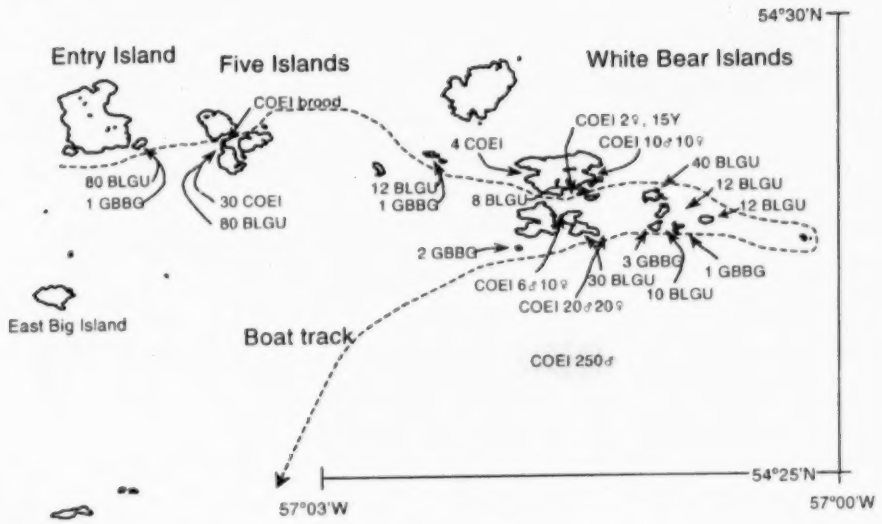

Figure 10. Boat survey for marine birds around the White Bear Islands, northern Groswater Bay, 2002.

Appendix 1. Bird species noted during seabird surveys in northern Groswater Bay, 1978 and 2002. These include incidental observations of other species, and incomplete counts of seabirds not suited for rigorous comparisons.

Island	1978	2002
East Big	Water Pipit (1 pair) Black Guillemot (6 on water) Razorbill (10 on water)	Water Pipit Black Guillemots (4 on water) Razorbill (57 on water) Atlantic Puffin (77 on water)
Bacalhao	Black Guillemot (4 on water) Razorbill (20-30 on island and water on 9 August) Black-legged Kittiwake (30-50 present 9 August, not nesting) Water Pipit (6) Rough-legged Hawk (active nest with 3 large young)	Black Guillemots (10 on water) Razorbill (9 on water) Atlantic Puffin (113 on water)
Tinker	Black Guillemots (3) Purple Sandpiper (4) White-rumped Sandpiper (3) Common Eider (3 nest with eggs, 1 brood) Barn Swallow (1) Water Pipit (1) Common Murre (1 on water)	Ruddy Turnstone (6)
Doughboy	none noted	none noted
Puffin Island	Common Murre (1 on water) Semipalmated Plover (1) American Golden Plover (1) Spotted Sandpiper (1 + chicks) Common Eider (8 females, 40+ ducklings) Water Pipit (4 pairs)	Peregrine Falcon (1)
Little South Puffin	none noted	none noted
Little East Puffin	Spotted Sandpiper (1 + chicks) Common Eider (nest with 3 eggs)	none noted
North Green	Herring Gull (1) American Golden Plover (4) White-rumped Sandpiper (22)	Ruddy Turnstone (2) White-rumped Sandpiper (1)
Herring-1 (Red)	Semipalmated Sandpiper (2) Least Sandpiper (1) Peregrine Falcon (1 female)	none noted

Herring-2 (Kipper)	Northern Fulmar (2 on water) Water Pipit (5) Pine Siskin (2) American Goldfinch (1) White-rumped Sandpiper (2) Semipalmated Sandpiper (4) Semipalmated Plover (1) Red-necked Phalarope (1) Phalarope spp. (10) Pectoral Sandpiper (1) Whimbrel (1) White-winged Scoter (8 flightless birds) Common Eider (30) Northern Raven (1) Black-legged Kittiwake (850) Peregrine Falcon (1 female) Horned Lark (2)	Common Murre (470 on cliff)
Herring-3 (Sardine)	Golden Plover (1) Least Sandpiper (2) Green-winged Teal (1)	Common Murre (165 on cliff) Canada Geese (30 on land) Great Black-backed Gull (5)
Quaker Hat	Dunlin (1) Ruddy Turnstone (1) White-rumped Sandpiper (9) Red-winged Blackbird (1 female) 1 Yellowthroat (1 female) Pine Siskin (3) Common Redpoll (2) Black-legged Kittiwake (300-500 on water) Leach's Storm-petrel (heard on island at night) Sooty Shearwaters (8 on water) Greater Shearwater (1 on water) Northern Fulmar (3 on water)	Razorbill (138 on land) Common Murre (38 on land) Raven (1) Great Black-backed Gull (4)
Entry Island	-	Great Black-backed Gull (1) Black Guillemots (80 on water)
Five Island	-	Common Eider (brood and 30 moulting males) Black Guillemots (50 on water)
White Bear Islands	-	Common Eider (286 males, 42 females, 15 ducklings) Great Black-backed Gulls (7) Black Guillemots (127 on water)

Appendix 2. Raw burrow density and occupancy data for Atlantic Puffins breeding on seven colonies in northern Groswater Bay, Labrador 1978 and 2002. For plot type, first00 denotes the first so many holes encountered, while 25 m^2 denotes a randomly placed plot (formed with a square in 1978 and circles in 2002).

Island	Plot	Plot type	Entrance	Short	Empty	Egg	Egg/ adult	Chick	Chick/ adult	Adult	Nest	Unknown	Date
Bacalhao	a1	first20	8	0	9	0	0	1	0	0	1	1	17 Aug 1978
Bacalhao	a2	first20	5	0	5	0	0	3	0	2	4	1	17 Aug 1978
Doughboy	a1	first25	2	0	6	6	2	1	0	3	1	4	6 Aug 1978
Doughboy	b1	first25	0	0	10	6	3	0	0	4	1	1	6 Aug 1978
East Big	a1	25 m^2	1	0	6	0	0	0	0	1	1	1	17 Aug 1978
East Big	e1	25 m^2	0	0	6	3	0	0	1	0	2	0	17 Aug 1978
East Big	e2	25 m^2	2	0	5	0	2	0	0	0	0	0	17 Aug 1978
East Big	f1	25 m^2	1	0	5	0	0	0	1	0	1	0	17 Aug 1978
East Big	i1	25 m^2	1	0	2	1	0	0	1	3	0	0	17 Aug 1978
North Green	f1	25 m^2	6	0	9	9	1	1	0	3	4	4	7 Aug 1978
North Green	d1	25 m^2	6	0	10	19	2	0	0	2	1	5	7 Aug 1978
North Green	d2	25 m^2	4	0	9	13	1	0	0	1	0	2	7 Aug 1978
North Green	e1	25 m^2	8	0	11	3	0	0	0	1	1	0	7 Aug 1978
Puffin	c1	25 m^2	4	0	13	3	2	0	0	2	0	6	4 Aug 1978
Puffin	c2	25 m^2	5	0	12	3	0	0	0	1	0	2	4 Aug 1978
Puffin	f1	25 m^2	9	0	15	6	4	0	0	5	2	2	4 Aug 1978
Puffin	h1	25 m^2	4	0	4	0	1	0	0	0	2	0	4 Aug 1978
Puffin	g1	25 m^2	2	0	9	0	1	0	0	0	0	3	4 Aug 1978
Puffin	g2	25 m^2	3	0	8	4	0	0	0	0	0	6	4 Aug 1978
Puffin	g3	25 m^2	2	0	14	6	3	0	0	2	1	3	4 Aug 1978
Tinker	1	first20	0	0	12	0	3	0	0	0	0	5	6 Aug 1978
Bacalhao	1	first20	4	3	3	3	0	0	0	1	6	0	21 Jul 2002
Doughboy	west	25 m^2	6	2	10	5	3	0	0	0	1	0	25 Jul 2002
Doughboy	east	25 m^2	0	4	7	0	3	2	1	0	0	0	25 Jul 2002
East Big	e1	25 m^2	5	5	6	1	0	0	0	0	0	1	21 Jul 2002
East Big	f1	25 m^2	3	0	11	0	0	0	0	0	0	0	21 Jul 2002
East Big	d1	25 m^2	2	2	5	1	0	0	0	0	1	2	21 Jul 2002
East Big	d2	25 m^2	2	9	1	0	0	0	0	0	0	1	21 Jul 2002
North Green	a1	25 m^2	16	1	5	2	0	0	0	0	0	1	23 Jul 2002
North Green	a2	25 m^2	8	6	6	10	1	0	0	2	0	3	23 Jul 2002
North Green	e1	25 m^2	13	2	11	5	3	0	0	2	0	1	23 Jul 2002
North Green	d1	25 m^2	4	7	6	3	3	0	0	0	1	1	23 Jul 2002
North Green	d2	25 m^2	5	0	8	3	2	0	0	0	0	1	23 Jul 2002
North Green	g1	25 m^2	8	4	5	6	2	0	0	1	0	2	24 Jul 2002
Puffin	c	25 m^2	6	4	8	1	4	0	0	0	0	0	24 Jul 2002
Puffin	e1	25 m^2	6	2	10	4	3	0	0	1	0	1	24 Jul 2002
Puffin	f1	25 m^2	13	3	15	3	2	0	0	2	2	0	24 Jul 2002
Puffin	f2	25 m^2	4	6	9	2	3	0	0	1	0	2	24 Jul 2002
Puffin	poor habitat	first100	12	40	43	5	0	0	0	3	0	5	24 Jul 2002
Tinker	1	first20	4	6	7	1	3	0	0	0	0	0	23 Jul 2002

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